

Simplified Hazard Analysis & Reporting ApP

Completed Technology Project (2015 - 2015)



Project Introduction

Since the crew will be so far away when exploring Mars, it is not going to always be practical for Mission Control to do as many things for them, and one thing they will likely need is a remote capability to perform hazard analysis. Since the crew will have to improvise their own procedures more frequently, being able to assign hazard controls and verifications will become increasingly important for them.

To address this issue I'm proposing the development of an app that aids the crew to perform simplified hazard analysis. The crew would answer some questions and the app would inform the crew of the hazards that would likely be of concern and would propose basic controls and verifications that should be considered. The crew could then implement hazard controls with greater independence and reduce their exposure to risk.

The Simplified Hazard Analysis & Reporting App (SHARP) addresses several core needs for humans to voyage deeper into space. First, SHARP gives the crew more autonomy to assess and act to mitigate risk, versus being reliant on earth-based support for hazard assessment, thus meeting HAT Performance Target 4.7c, Crew Autonomy Beyond LEO. In a similar vein, HAT Performance Target 7.5a, Mission Control Automation Beyond LEO, is also relevant since the MER in Mission Control currently provides short turn around hazard assessment, whereas SHARP would allow the crew to do a range of hazard assessment on their own quickly. Additionally, since Mission Control will not be able to converse easily with Mars based crews, there will be a greater need to automate the reporting of data. SHARP will incorporate a feature to send hazard assessment the crew are working on to Mission Control for further analysis.

SHARP will be developed in two stages. First, a mapping of the logic to drive the app will be documented. This logic map will develop the questions that will be asked of the crew and the answers that will be returned to them. The focus will be on making the tool user friendly while providing useful control strategies for a broad range of hazardous conditions. Second, a prototype app will be developed to act as a testbed for the user interface and prove out the usefulness of the logic map. Finally, at a later time, a reporting function will be incorporated.

SHARP will have two product deliverables. The first will be the logic map, which traces a series of questions to a group of answers that inform the crew about the hazards they are likely to encounter in their chosen task, and what controls and verifications they should attempt to implement to mitigate the risk. The second would be a prototype app, which would be the user interface and testbed of the logic map. The app would, with further development, become the end product for the crew.



SHARP Hazard Analysis

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Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Independent Research & Development: JSC IRAD

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This ICA submission is to take the idea from practical idea (TRL 2) to the prototype phase (TRL 3). The next steps would be to apply for further ICA and other innovation related funding to further refine the useability and the usefulness of the answers provided by the app (TRL 4 & 5). Beyond that, conversations with the S&MA directorate, the Orion Program, and with other potential stakeholders would take place to initiate a development project once its potential usefulness becomes evident.

Anticipated Benefits

ORION: SHARP gives the crew more autonomy to assess and act to mitigate risk, versus being reliant on earth-based support for hazard assessment, thus meeting HAT Performance Target 4.7c, Crew Autonomy Beyond LEO. In a similar vein, HAT Performance Target 7.5a, Mission Control Automation Beyond LEO, is also relevant since the MER in Mission Control currently provides short turn around hazard assessment, whereas SHARP would allow the crew to do a range of hazard assessment on their own quickly. Additionally, since Mission Control will not be able to converse easily with Mars based crews, there will be a greater need to automate the reporting of data. SHARP will incorporate a feature to send hazard assessment the crew are working on to Mission Control for further analysis.

ISS: SHARP could be used by current ISS crews to practice doing their own hazard analysis. Mission Control could compare their hazard analysis to the ISS crew's analysis and gauge how well the tool is performing. This could help the crew's ability to conduct their own hazard analysis for less critical tasks, thus saving time and effort by ground teams and help make SHARP a better tool by providing performance feedback.

Just as SHARP helps with Orion's trips to Mars, it can be used for any mission in which the crew needs extra autonomy from earth. SHARP's purpose is to improve the safety and reduce the risk of the crew's when they perform improvised or otherwise unplanned activities.

The ability to perform hazard analysis is essential to improving the safety and security of any human activity that involves significant risk. Currently, most organizations centralize their ability to conduct hazard analysis (usually a safety and reliability group) and simply distribute the results to the users. This tool allows the end user to perform simplified hazard analysis and take action to reduce their risk when access to the centralized safety organization is unavailable or sufficiently hindered. As commercial organizations venture deeper into space, or as they experiment with granting their crew's greater autonomy, increasing their crew's ability to assess hazards and plan accordingly will become a critical feature to mission success. This tool is one approach to improving crew's abilities to identify hazards and implement appropriate controls.

Project Management

Program Manager:

Carlos H Westhelle

Project Manager:

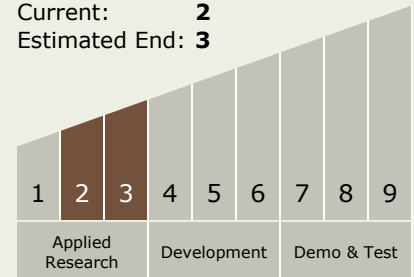
Ryan M Lawrence

Principal Investigator:

Ryan M Lawrence

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

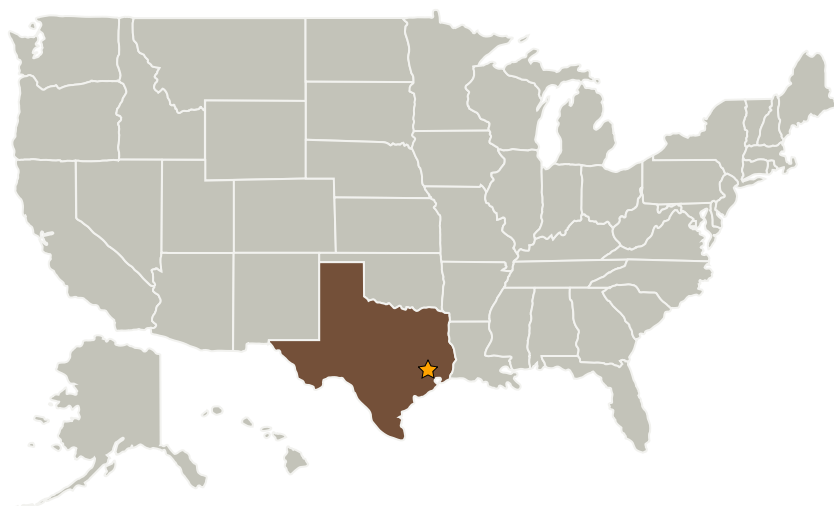
- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.3 Human Health and Performance
 - └ TX06.3.3 Behavioral Health and Performance

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Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|--|-------------------------|---|-------------------|
| ★ Johnson Space Center(JSC) | Lead Organization | NASA Center | Houston, Texas |
| GHG Corp. | Supporting Organization | Industry Small Disadvantaged Business (SDB), Veteran-Owned Small Business (VOSB) | |
| Science Applications International Corporation(SAIC) | Supporting Organization | Industry | Boulder, Colorado |

Primary U.S. Work Locations

Texas



Images



SHARP Logo

SHARP Hazard Analysis

(<https://techport.nasa.gov/image/16349>)